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United States Patent [19][11] **Patent Number:** **5,835,616****Lobo et al.**[45] **Date of Patent:** **Nov. 10, 1998**[54] **FACE DETECTION USING TEMPLATES**[57] **ABSTRACT**[75] Inventors: **Niels da Vitoria Lobo; Young Ho Kwon**, both of Orlando, Fla.[73] Assignee: **University of Central Florida**, Orlando, Fla.[21] Appl. No.: **261,947**[22] Filed: **Jun. 17, 1994****Related U.S. Application Data**

[63] Continuation-in-part of Ser. No. 198,816, Feb. 18, 1994, abandoned.

[51] **Int. Cl.⁶** **G06K 9/00**[52] **U.S. Cl.** **382/118; 382/115**[58] **Field of Search** 382/115, 117, 382/118, 190, 199; 235/382, 380; 340/825.34[56] **References Cited****U.S. PATENT DOCUMENTS**

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|-----------|---------|-----------------|-------------|
| 3,805,238 | 4/1974 | Rothjell | 340/146.3 E |
| 4,516,262 | 5/1985 | Sakurai | 382/18 |
| 4,792,900 | 12/1988 | Sones et al. | 382/131 |
| 4,858,000 | 8/1989 | Lu | 358/84 |
| 4,975,969 | 12/1990 | Tal | 382/2 |
| 5,008,946 | 4/1991 | Ando | 382/117 |
| 5,012,522 | 4/1991 | Lambert | 382/2 |
| 5,163,094 | 11/1992 | Prokoski et al. | 382/2 |
| 5,164,992 | 11/1992 | Turk et al. | 382/2 |
| 5,339,367 | 8/1994 | Roth | 382/199 |
| 5,432,864 | 7/1995 | Lu et al. | 382/118 |
| 5,432,866 | 7/1995 | Sakamoto | 382/117 |

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Disclosed is a two step process for automatically finding a human face in an electronically digitized image (for example, taken by handheld digital cameras and digital video-cameras such as cam-corders), and for confirming the existence of the face by examining facial features. Step 1 is to detect the human face and is accomplished in stages that include enhancing the digital image with a blurring filter and edge enhancer in order to better set forth the unique facial features such as wrinkles, and curved shapes of a facial image. After prefiltering, preselected curves sometimes referred to as snakelets are dropped on the image where they become aligned to the natural wrinkles and curves of a facial image. Step 2 is to confirm the existence of the human face in seven stages by finding facial features of the digital image encompassing the chin, sides of the face, virtual top of the head, eyes, mouth and nose of the image. Ratios of the distances between these found facial features can be compared to previously stored reference ratios for recognition. This method for detecting facial features of an image can be used in applications such as but not limited to detecting human faces for the gathering of population age-statistics from patrons at entertainment/amusement parks and television network viewer-rating studies. Such gathering can include counting the patrons, distinguishing certain age and gender groups, and/or identifying specific people. Computer vision with this capability can further have application in such fields as automated surveillance systems, demographic studies, automated photography for point-and-shoot cameras and human computer interactions. Automated photography can eliminate the manual adjustment problems that result in poor quality from lack of focused subjects. Computer systems can utilize this system to recognize and respond to the specific needs of a user, and further translate for human users.

3 Claims, 19 Drawing Sheets